

NOTE UPON THE TRILOBITES OF THE SHALES OF THE HUDSON-RIVER GROUP IN THE TOWN OF GEORGIA, VERMONT.

IN the Regents' Twelfth Annual Report on the New-York State Cabinet of Natural History, I described three species of TRILOBITES from the shales of the upper part of the Hudson-river group in Georgia, Vermont. I then referred two of these, with some hesitation, to the Genus *OLENUS* (DALMAN), and one to *PELTURA* (MILNE-EDWARDS); following the reference to *Peltura* (*Olenus*) *scarabæoides*, as the type. A further examination of these specimens, and some others, has satisfied me of the impropriety of this reference. Although in many respects approaching to *OLENUS*, these forms differ in some important features; and, in order to avoid confusion, they require a distinct designation. In their general aspect, and in some of the details, these fossils bear a resemblance to *PARADOXIDES*; from which they are at once distinguished by the less proportional elongation of the body, the smaller number of articulations of the thorax, the direction of the groove or furrow in the lateral segments, and by the form of the glabella. In the first point they also differ from *OLENUS*, which, though having fewer articulations of the thorax, has a larger number than in our fossils. In their general aspect and expression, these fossils are of what might be termed a "primordial type;" but yet differ from any of the TRILOBITES in our extreme lower formations sufficiently to be readily distinguished from them.

The genus *PARADOXIDES* was established by BRONGNIART in 1822 (*Crust. foss.* p. 30); and the fossil described by LINNE under the name of *Entomolitus paradoxus*, as figured and described by WAHLENBERG (*Act. Soc. Upsal.* 1821, pa. 31, pl. 1, f. 16), was made the type of the genus under the name *Paradoxides tessini*. Under the same genus were included *P. spinulosus*, *P. scarabæoides* and *P. laciniatus*; species described by WAHLENBERG, reproducing the figures of that author, and giving an additional illustration of *P. spinulosus*.

In 1826, DALMAN, admitting the Genus *PARADOXIDES* of BRONGNIART, nevertheless proposed the name *OLENUS* to include the four first named species; placing *P. tessini* and *P. spinulosus* in the first section, and the others in the second section of the new genus, proposing the generic name of *LICHAS* for the *P. laciniatus* of BRONGNIART. Subsequently the three species *P. spinulosus*, *P. gibbosus* and *P. scarabæoides* have been regarded as distinct from *PARADOXIDES*, and made the foundation of the Genus *OLENUS*; while the latter of these has more recently been placed under the Genus *PELTURA*.

In *PARADOXIDES*, as now established, we have species with broad lunate cephalic shields, with the glabella wider in front: the body or thorax has from sixteen to twenty articulations; the pygidium is narrow, with two to three and even five and eight segments, while the lateral lobes are little developed.

In *OLENUS*, the cephalic shield is comparatively broader and shorter, the glabella narrowing (or not broader) anteriorly: the number of thoracic segments is from fourteen to sixteen; the caudal shield is broader than long and semicircular, the lateral lobes being more developed than in *PARADOXIDES*, and both marked by transverse rings or ridges.

M. BARRANDE makes the following comparisons between *PARADOXIDES* and *OLENUS*:

"In establishing the family for which we have given *PARADOXIDES* as the type,
[Senate, No. 89.]

we have indicated the characters common to the genera which constitute it. Notwithstanding their affinities, it is easy to recognize at a glance that the PARADOXIDES are distinguished by the large number of segments, the form of ribs, the hypostoma, the great prolongation of the cephalic limb, the very elongated eyes, and the general appearance. The only type where it is difficult to establish a strong line of demarkation is OLENUS; particularly when we consider *P. spinulosus*, which approaches nearest to PARADOXIDES, and which BURMEISTER has classed with them. Not having at our disposal the materials necessary to show fully the distinction between these two genera, we will confine our remarks to, 1, That in OLENUS, the glabella has a form constantly narrowing towards the front, and which contrasts with those of the PARADOXIDES; 2, the lateral furrows of OLENUS are very much inclined, and rarely unite in pairs on the axis, while in PARADOXIDES they are almost horizontal, and the two last pairs generally form two parallel branches traversing the glabella; 3, the number of thoracic segments in the first genus appears not to exceed fifteen or sixteen, which is the least number observed in the second; 4, the pygidium of OLENUS usually differs from that of PARADOXIDES by a greater relative development of the lateral lobes. We hope that the Swedish savants will be able to define the limits between the two genera. The discovery of the hypostoma of OLENUS would contribute much to attain this end.”*

In comparing our own species with OLENUS, we find some differences in the form of the cephalic shield, but more particularly in the form of the glabella; which, however, from imperfection in the specimens, does not admit of minute comparisons. Our specimens have no more than thirteen or fourteen segments of the thorax (and the one referred to PELTURA has eleven), instead of fifteen or sixteen, and the direction of the lateral furrow is different. The greater development and extension of the third segment of the thorax is a remarkably distinctive character, and the same feature is shown in the posterior segments of one species. The form and development of the pygidium also differs from that of OLENUS, in the lesser lateral expansion, and absence of segments on the lateral lobes.

When we compare with PARADOXIDES, we find the cephalic shield proportionally broader and shorter, while there is no expansion of the glabella towards the front; nor do the transverse furrows extend entirely across this part, except at its base. This feature and the facial suture, though indistinct, correspond more nearly with OLENUS.

The smaller number of thoracic segments is a distinguishing feature, and the direction of the segment-furrow differs essentially. In one feature, that of the greater development of the *third* segment, it corresponds with PARADOXIDES, where the *second* segment has a greater development than the others. In the extreme development of the posterior segments, in one species, there is likewise a similarity with PARADOXIDES. In the slight development of the pygidium, our fossil corresponds in some degree with PARADOXIDES.

In the perfect condition, one species appears to have been furnished with a row of nodes or spines along the dorsal ridge.

We have, therefore, although the material is imperfect, the means of showing well-marked distinctions between these forms and the allied Genera OLENUS and PARADOXIDES.

The species referred to PELTURA has the cheeks separated, and therefore there is some obscurity about the suture margins. The expansion of the lateral lobes of the thorax is imperfect in the specimen figured; but, from examination of this and other specimens, the third segment does not appear to have been prolonged as in

* BARRANDE, *Système Silurien du centre de la Bohême*, Vol. i, p. 367.

the two others. The pygidium has four or five rings on the axis, and the lateral lobes are expanded and the extremity rounded; moreover I am able to count but eleven articulations in the thorax: these, with other characters enumerated, seem to exclude it from generic association with the two species referred to *OLENUS*. For these, excluding the one referred to *Peltura*, I would propose the generic designation *BARRANDIA*.

GENUS *BARRANDIA** (n. g.).

GENERAL form broadly ovate or elongate ovate, distinctly trilobate. Cephalic shield broad, somewhat semicircular; the width more or less than twice the length, with the posterior angles projecting in long spiniform points: the posterior margin is nearly straight or slightly concave, with a slight sinuosity at the outer angle just within the cephalic limb; the anterior and lateral margins have a thickened or elevated border, within which is a well marked groove or depression of the crust. The glabella is well pronounced, of nearly equal width throughout, or slightly narrowing and rounded in front; marked by three pairs of furrows (perhaps from two to four), the posterior one of which is nearly or quite continuous across from the posterior angles of the eyes. The facial suture has not been fully determined, but appears to extend in a curving line from the front margin to the anterior angle of the eye, and from the posterior angle of the eye it turns abruptly outwards towards the postero-lateral angle of the cephalic shield.

EYES large and well developed, elongate semilunate, extending from near the base of the shield more than halfway to the anterior margin. Hypostoma broadly ovate, little longer than wide.

THORAX composed of thirteen or fourteen articulations; the axis being moderately convex, and usually much narrower than the lateral lobes (and sometimes apparently marked by a row of nodes or short spines along the summit). Lateral lobes nearly flat; the ribs, to about the eighth or ninth, extending almost rectangularly, or slightly inclined from the axis for one-third to one-half their length, where they are bent abruptly backwards. The third segment is stronger, and much more prolonged than the others. The last segments of the lateral lobes are produced directly backwards, or sometimes a little convergent below. The segments of the lateral lobes are marked by a broad longitudinal furrow nearly parallel to the anterior margin; leaving an abruptly elevated ridge or border upon that side as far as the geniculation of the segment, where the groove runs along the centre, dying out on the recurved extremities.

PYGIDIUM distinct, narrow, elongated, the axis narrow and acutely pointed; without rings? Lateral lobes narrow or obsolete, and free from transverse ridges or furrows.

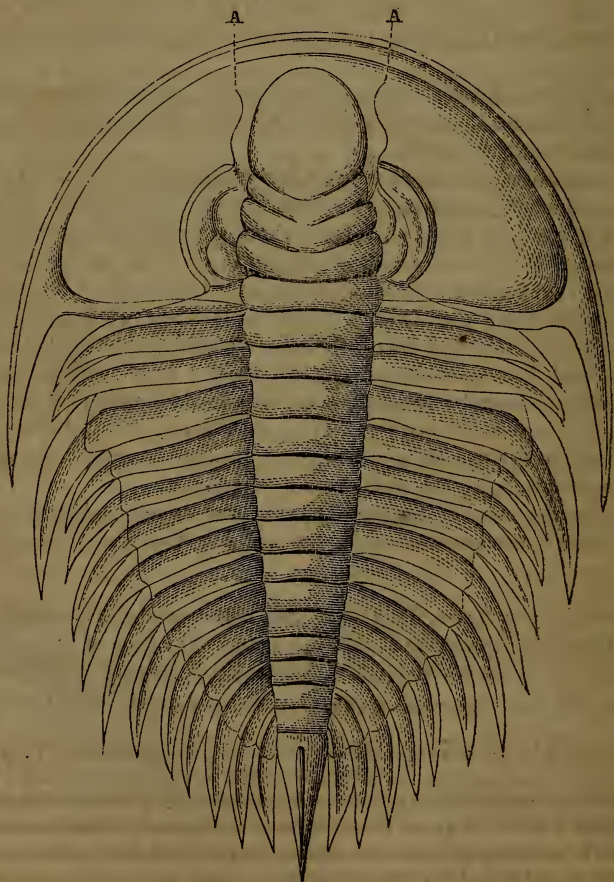
The accompanying figure, illustrating this genus, combines characters observed in several imperfect specimens of the same species. The form of the cephalic shield is shown in two or three individuals: the glabella is crushed in all the specimens examined; but the form is made out, as nearly as possible, from the materials in

* In honor of M. J. BARRANDE, author of *Système Silurien de Bohême*. I can only regret that I have not something of greater importance to offer as a tribute to the name, and in commemoration of the rare merits and eminent services in the cause of science, of this distinguished palæontologist. I believe, however, that these forms will hereafter be found to mark an important horizon in our geological series; associated as they are with other forms that indicate the last appearance and final dying out of the types of that ancient crustacean fauna, which marked, so far as we now know, the dawn of life upon our planet.

our possession, and cannot vary much from the truth. There are three pairs of glabellar furrows anterior to the occipital furrow. In the area between the extremities of the glabella lobes and the eyes, there are on each side, in the species figured, two low oblong tubercles; but I cannot be sure that these are of generic importance, and it might be supposed possible that this appearance is due to the crushing of a prominent part of the crust, were it not that the feature is symmetrical and correspondent on the two sides.

The facial suture can be traced a little forward of the eye, but its direction on the anterior margin has not been ascertained: on the posterior margin, its direction is shown as accurately as it can be from crushed and distorted specimens. The body, or thorax and pygidium, is drawn essentially from a single individual. The line just within the free extremities of the pleura is shown in this and other specimens, and indicates the limits of the crust on the lower side. The caudal shield shows no more than the axis which is prolonged into a slender pointed spine, strengthened by a sharp elevated ridge beginning near the anterior margin, and extending to the extremity.

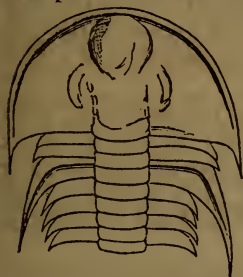
The entire absence, so far as can be seen, of lateral lobes of the pygidium, is a marked feature; and this especially is in strong distinction with *OLENUS*.



BARRANDIA THOMPSONI.

BARRANDIA VERMONTANA*.

The accompanying figure of *B. vermontana* illustrates also the character of the cephalic shield, and the greater strength and extension of the third articulation of the thorax. The fragment of thorax and pygidium, heretofore referred to this species (Twelfth Annual Report of the Regents), prove, on farther examination, to be parts of the following or a similar species there referred to *PELTURA*.



BARRANDIA VERMONTANA.

The head and part of the thorax. The remaining parts of the animal are unknown.

In my examinations of these TRILOBITES, I had hoped to unite the three forms heretofore described, under a single genus; but on more careful comparisons, I find that the one before referred to *PELTURA* is so dissimilar, that I am unable, by any proper extension of the generic characters of *BARRANDIA*, to include it in the same genus. In the specimen figured, and in two others which appear to possess the thorax and pygidium entire, there are but eleven thoracic segments; the third segment is not enlarged and produced as in *BARRANDIA*, but, on the other hand, the anterior segments, to the number of five or six, are little prolonged at their extremities: the prolongation increases in the posterior segments, while the last one of the thorax is enlarged as it recedes from the axis, and at its broadest part makes an abrupt geniculation, turning almost rectangularly backwards, is prolonged into sharp spines in a direction parallel to the axis and extending beyond the pygidium. The axis of the pygidium is marked by three rings, while the lateral lobes are apparently smooth (in one specimen), and the entire form is semielliptical, the axis obtuse at its posterior extremity, and bordered by a smooth extension of the crust from the lateral lobes; which is in strong contrast with the preceding genus. Nor can it be properly placed under *PELTURA*, which has twelve segments of the thorax, the cephalic shield not extended in the posterior limb, nor the last segment of the thorax produced as in the present form; while the pygidium is emarginate at the extremity, and dentate on the margins.

While the glabella has the form of *OLENUS*, and the general form of the cephalic shield corresponds to that genus, the extension of the last segment of the body in spines parallel to the axis is a character of the typical species of *PARADOXIDES* (see *P. bohemiensis*): the pygidium is also much more nearly of the type of *PARADOXIDES*, than of *OLENUS* or *PELTURA*.

I propose therefore to designate this form by the generic name *BATHYNOTUS*.

GENUS BATHYNOTUS (n. g.).

[Gr. *βαθυς*, *amplus*, and *νωτος*, *dorsum*; in allusion to the ample central lobe or axis of the typical species.]

GENERAL form elongate ovate, distinctly trilobate. Cephalic shield somewhat semielliptical, with the posterior angles prolonged in spiniform processes: po-

* This and the preceding species were published as *Olenus thompsoni* and *O. vermontana*, in the Twelfth Annual Report of the Regents of the University on the State Cabinet of Natural History, pp. 59 & 60.

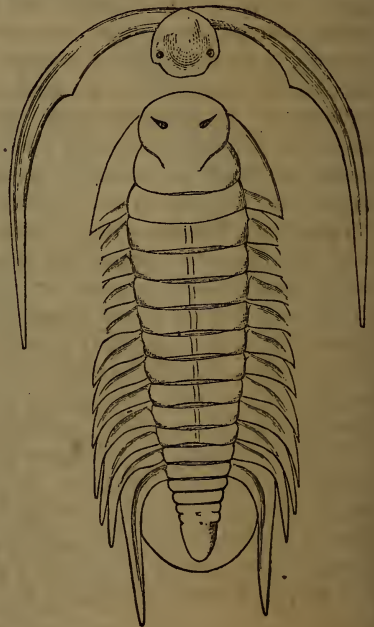
sterior margin nearly straight across the centre, and a little concave at the sides; anterior and lateral margins somewhat thickened. The facial suture (to judge from the separated parts) is very simple, extending in a slightly curving line from the front of the shield backwards, and coming to the posterior margin within the limb. The glabella is prominent and well defined, ovate in form and gradually narrowing towards the front: the occipital furrow extends directly across the glabella; the first pair of furrows above this are oblique and only slightly connected across the middle of the glabella, while anterior to these are two slight indentations. Hypostoma subcircular, with the posterior end a little wider. Eyes unknown.

THORAX composed of eleven articulations; the axis broad and prominent, wider than the lateral lobes. Lateral lobes nearly flat, narrow: the first five or six ribs short and narrow, inclining gently backwards; the posterior ones becoming more abruptly bent and prolonged at the extremities, while the last pair are wider and stronger, bent almost rectangularly, and produced in spiniform extensions much beyond the others.

PYGIDIUM distinct, semioval, the axis marked by several annulations, the lower part plain. Lateral lobes plain or marked by ridges, and extending beyond the axis in a continuous flattened expansion.

BATHYNOTUS HOLOPYGA*.

There are but three distinct rings in the axis of the pygidium, though there is a fourth indistinct depression, which may or may not indicate a fourth ring.



BATHYNOTUS HOLOPYGA.

The single species described in the last Report is illustrated in the accompanying figure. The specimen is a mould or impression from which most of the crust has been removed, and we have the relief from a cast made in this mould. The cheeks are separated and turned on one side; but in the drawing, they are placed in symmetrical relation with the other parts of the animal. The rings of the axis are marked

* *Olenus (Peltura) holopyga*: Twelfth Annual Report of the Regents of the University, on the State Cabinet of Natural History, p. 61.

by a row of small spines. The great length of the spines or processes, from the posterior angles of the cephalic shield, is a remarkable feature : in this individual, their extremities must have reached as far as the eighth or ninth segment of the thorax; and in another individual, these separated parts have similar proportions.

In one imperfect specimen of this species, with narrower axis, we have eleven body rings, including the elongated posterior one; but behind this there are three annulations of the axis, the two anterior of which have somewhat the appearance of free segments, and are likewise marked upon the lateral lobes; while the pygidium below has apparently a single annulation, extending into the lateral lobe.

This one appears to be specifically distinct from the preceding, in its narrower axis : nevertheless this feature may be due to distortion, as also some other points of apparent difference.

It is to be regretted that the materials at my disposal are so imperfect as to leave some points yet in doubt; but I conceive that there can be no hesitation in admitting the generic distinction of these fossils, from those of any established genus of *TRILOBITES*; and however much, therefore, we may desire to avoid the multiplication of genera, it seems to be unavoidable in the present instance.

The geological horizon of the shales in which these trilobites occur having been made a matter of discussion among geologists, I shall refer those interested in the subject to the forthcoming Report upon the Geology of the State of Vermont by Prof. E. HITCHCOCK.

NOTE. I may remark, in this place, that the disposition of these three species does not include two which I have designated as *OLENUS* in the first volume of the *Palæontology of New-York* (p. 256 - 258, pl. 67, f. 2, 3). One, the *O. asaphoides*, showing six of the lateral ribs of the thorax, has no ribs larger or longer than the others, though the form of the cephalic shield and the glabella are very similar to *BARRANDIA* : in that one there are four pairs of glabellar furrows, the two posterior ones of which are slightly indented across the centre of the glabella. The eyes are elongated, and more curved than in *Barrandia thompsoni*. We have, therefore, yet other undetermined material in these slates.

NEW SPECIES OF FOSSILS FROM THE HUDSON-RIVER GROUP OF OHIO, AND OTHER WESTERN STATES.

CALYMENE CHRISTYI (n. s.).

GENERAL form elongate ovate, symmetrical: body gibbous, the pygidium equalling the length of the head. Head semicircular, the frontal border expanded, and gradually narrowing on the sides; the posterior angles terminating in a short sharp spine. Glabella wide, slightly narrowing towards the front, regularly convex, strongly defined by the dorsal furrows, a little concave in the middle of the base : occipital furrow well defined, nearly straight, and in right line with the cheek furrows; posterior furrow oblique, defined but not deep; the middle one nearly rectangular to the axis, while the anterior one is but slightly indented. The posterior lobe is much wider than the middle one, and about the same width as the anterior one. Cheeks small. Eyes very prominent.

THORAX with thirteen segments; the axis salient, and a little wider in the middle than the lateral lobes; the articulations of the latter flat, or slightly curving for a little more than one-third their length, when they are suddenly bent downwards.

THE PYGIDIUM is gibbous, semielliptical, with the axis very prominent and marked by seven or eight rings, the last one being longer and more prominent, with a minute scarcely defined node at the extremity : lateral lobes marked by six flattened ribs, the last one of which is minute, the expansion being continued in a narrow flattened border around the posterior extremity.